WEB-TC

8-Channel Thermocouple Measurement with Web Interface

User's Guide

MEASUREMENT COMPUTING

WEB-TC

8-Channel Thermocouple Measurement with Web Interface

User's Guide

MEASUREMENT COMPUTING™

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Table of Contents

Preface
About this User's Guide 7
What you will learn from this user's guide 7
Conventions in this user's guide 7
Where to find more information 7

Chapter 1
Introducing the WEB-TC 8
Web interface 8
TCP/IP connection 8
Browser requirement 8
WEB-TC features 8
Thermocouple input channels 8
Alarms 9
Digital I/O channels 9
WEB-TC block diagram 9
Software features 9

Chapter 2
Installing the WEB-TC 10
What comes with your WEB-TC shipment? 10
Hardware 10
Additional documentation 11
Unpacking the WEB-TC 11
Installing the software 11
Connecting the AC power adapter 11
Connecting the WEB-TC 11
Connecting to a LAN for communication within a network 12
Connecting to a LAN for communication across networks 12
Connecting the WEB-TC directly to a computer 13
Using the web interface 14
Logging in to a device 15
Configuring the WEB-TC using *Insta*Cal 15
Setting the network parameters 15
Calibrating the WEB-TC 16
Warm-up period 16

Chapter 3
Signal I/O Connections 17
Screw terminal pin out 17
Thermocouple input terminals (C0H/C0L to C7H/C7L) 18
CJC sensors 18
Digital terminals (DIO0 to DIO7) 18
Pull-up/down terminal (PU/D) 19
Ground terminals (AGND and GND) 19
Power terminal (+5V) 19
Thermocouple connections 19
Wiring configuration 19
Digital I/O connections 20
Configuring the DIO channels to generate alarms 20

Chapter 4
Functional Details 21
Thermocouple measurements 21
Cold junction compensation (CJC) 21
Data linearization 21
Open-thermocouple detection (OTD) 21
External components 21
Screw terminals 22
Ethernet port 22
External power connector 22
POWER/COMM LED 22
LINK/ACTIVITY LED 23
Digital logic voltage switch 23
Factory default reset button 23
Chapter 5
Ethernet Troubleshooting 24
Check the WEB-TC status LEDs 24
Check the network settings on the computer 25
Check whether DHCP is enabled on the network server 25
Verify that the computer is connected to the network 25
Verify the network path to the WEB-TC 26
Verify the network path to a remote WEB-TC 27
Check cached information 27
Deleting a NetBIOS table entry 27
Deleting an ARP table 27
Getting help 27
Chapter 6
Specifications 28
Analog input 28
Channel configurations 28
Compatible thermocouples 29
Accuracy 29
Thermocouple measurement accuracy 29
Throughput rate 30
Digital input/output 31
Temperature alarms 31
Memory 31
Microcontroller 31
Power 32
Network 32
Ethernet compliance 32
Ethernet connection 32
Network factory default settings 32
Network protocols 33
Network security 33
LED displays and the factory reset button 33
Environment 33
Mechanical 33
Screw terminal connector type and pin out 34
Declaration of Conformity 35

About this User's Guide

What you will learn from this user's guide

This user's guide explains how to install, configure, and use the WEB-TC so that you get the most out of its web-server based thermocouple measurement features.

This user's guide also refers you to related documents available on our web site, and to technical support resources.

Conventions in this user's guide

For more information on …

Text presented in a box signifies additional information and helpful hints related to the subject matter you are reading.

Caution! Shaded caution statements present information to help you avoid injuring yourself and others, damaging your hardware, or losing your data.

<#:#> Angle brackets that enclose numbers separated by a colon signify a range of numbers, such as those assigned to registers, bit settings, etc.

bold text **Bold** text is used for the names of objects on the screen, such as buttons, text boxes, and check boxes. For example:
1. Insert the disk or CD and click the **OK** button.

italic text *Italic* text is used for the names of manuals and help topic titles, and to emphasize a word or phrase. For example:
The *InstaCal* installation procedure is explained in the *Quick Start Guide*.
Never touch the exposed pins or circuit connections on the board.

Where to find more information

The following electronic documents provide helpful information relevant to the operation of the WEB-TC.

- MCC's *Specifications: WEB-TC* (the PDF version of the *Specifications* chapter in this guide) is available on our web site at www.mccdaq.com/pdfs/WEB-TC.pdf.
- MCC's *Quick Start Guide* is available on our web site at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf.
- MCC's *Guide to Signal Connections* is available on our web site at www.mccdaq.com/signals/signals.pdf.
- MCC's *Universal Library User's Guide* is available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf.
- MCC's *Universal Library Function Reference* is available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-functions.pdf.
- MCC's *Universal Library for LabVIEW™ User's Guide* is available on our web site at www.mccdaq.com/PDFmanuals/SM-UL-LabVIEW.pdf.

WEB-TC User's Guide (this document) is also available on our web site at www.mccdaq.com/PDFmanuals/WEB-TC.pdf.

For installation information, refer to the *WEB-TC setup options* that shipped with the device.

Introducing the WEB-TC

The WEB-TC is a thermocouple measurement device with a built-in web server. You can connect the device to an Ethernet port or hub, start up your browser, and view current data.

The WEB-TC is fully supported by the Universal Library and TracerDAQ. These software programs are included on the *Measurement Computing Data Acquisition Software* CD.

Web interface

The WEB-TC's embedded web interface provides access to current data and configuration settings using a standard web browser.

Browse to the device's home page by entering the URL that is printed on the device into the browser. View current thermocouple measurements and channel data, and configure hardware options from the device's home page. Only one user can change configuration options on the device at a time.

The web interface is built into the device's firmware, and does not need to be installed on a computer. No external software is required other than a web browser and a TCP/IP connection.

TCP/IP connection

A TCP/IP connection is required to access the web interface. Connect the device's 10Base-T Ethernet port to a local or wide area network using the supplied Ethernet cable, to a single computer through a hub using the supplied Ethernet cable, or directly to a computer using a standard CAT-5 crossover cable.

Browser requirement

The web browser used to access the WEB-TC's web interface must support JavaScript. The web interface was tested with the following browsers for compatibility:

- Mozilla Firefox™ 2.x
- Microsoft Internet Explorer® 6.x
- Microsoft Internet Explorer® 7.x

WEB-TC features

The WEB-TC provides eight thermocouple channels and eight digital I/O channels. An external supply shipped with the device provides power. On-board LEDs display the status of communication and external power.

All hardware configurable options are selectable with the web browser or *Insta*Cal. Network configurable options are settable with *Insta*Cal. When using *Insta*Cal, if the login settings have been changed from the default, a login name and password are required to change the configuration settings.

Thermocouple input channels

The WEB-TC provides eight differential thermocouple input channels. A 24-bit analog-to-digital (A/D) converter is provided for each pair of analog inputs.

You can take measurements from type J, K, R, S, T, N, E, and B thermocouples. The thermocouple type is software programmable for each channel.

Four cold junction compensation (CJC) sensors are provided for thermocouple measurements. Each CJC sensor is dedicated to two thermocouple input channels. An open thermocouple detection feature lets you detect a broken thermocouple. An on-board microprocessor automatically linearizes the measurement data.

Alarms

The WEB-TC features eight independent temperature alarms. Each alarm controls an associated digital I/O channel as an alarm output. The input to each alarm is one of the temperature input channels. The output of each alarm is software-configurable as active high or low. The user-configurable threshold conditions activate each alarm. When an alarm is activated, the associated DIO channel is driven to the active output state selected.

Digital I/O channels

Eight digital I/O channels are provided to communicate with external devices and to generate alarms. The digital bits are software programmable for input or output. The digital output voltage is switch-selectable for 3.3 V or 5 V logic. A screw terminal is provided for pull-up or pull-down configuration.

The digital I/O channels power up in input mode unless the bit is configured for an alarm. When a digital bit is configured as an alarm, that bit is configured as an output and assumes the state defined by the alarm configuration.

If you need to log data or display data graphically

The WEB-TC displays current data read from the device, and does not log or store historical data. For logging or trending needs, use the TracerDAQ software included on the *Measurement Computing Data Acquisition Software* CD.

WEB-TC block diagram

WEB-TC functions are illustrated in the block diagram shown here.

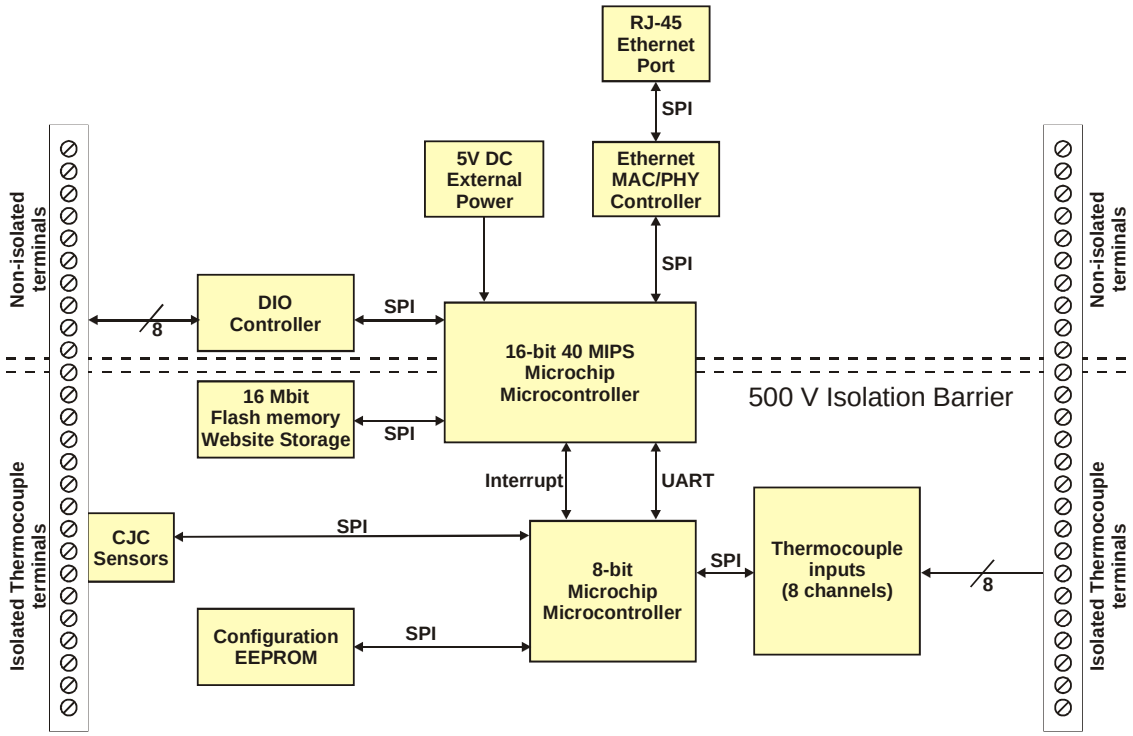


Figure 1. WEB-TC functional block diagram

Software features

For information on the features of *Insta*Cal and the other software included with your WEB-TC, refer to the *Quick Start Guide* that shipped with your device. The *Quick Start Guide* is also available in PDF at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf.

Check www.mccdaq.com/download.htm for the latest software version.

Installing the WEB-TC

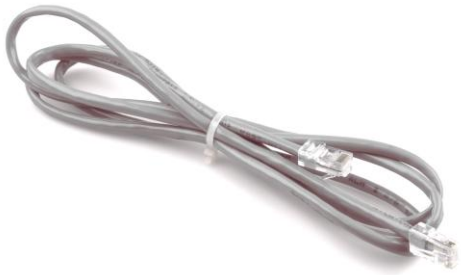
What comes with your WEB-TC shipment?

The following items are shipped with the WEB-TC.

Hardware

- WEB-TC

- Ethernet cable (standard)



You can optionally purchase a crossover cable (CAT-5 or higher) to connect the WEB-TC to an Ethernet card installed in a computer.

- External power supply and cord – 10 watt AC power adapter. MCC part number PS-5V2AEPS.

Additional documentation

In addition to this hardware user's guide, you should also receive the *Quick Start Guide* (available in PDF at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf). This booklet supplies a brief description of the software you received with your WEB-TC and information regarding installation of that software. Please read this booklet completely before installing any software or hardware.

An overview of installation options is provided in the *WEB-TC setup options* page that ships with the device. Detailed installation information is provided in this user's guide.

Unpacking the WEB-TC

As with any electronic device, you should take care while handling to avoid damage from static electricity. Before removing the WEB-TC from its packaging, ground yourself using a wrist strap or by simply touching the computer chassis or other grounded object to eliminate any stored static charge.

If your WEB-TC is damaged, notify Measurement Computing Corporation immediately by phone, fax, or e-mail.

- Phone: 508-946-5100 and follow the instructions for reaching Tech Support.
- Fax: 508-946-9500 to the attention of Tech Support
- Email: techsupport@mccdaq.com

For international customers, contact the local distributor where you purchased the WEB-TC. Click on this link www.measurementcomputing.com/sales.asp to locate your distributor.

Installing the software

Refer to the *Quick Start Guide* for instructions on installing the software on the *Measurement Computing Data Acquisition Software CD*. This booklet is available in PDF at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf.

Connecting the AC power adapter

Power to the WEB-TC is provided with the 10 watt AC power adapter (PS-5V2AEPS). Connect the adapter cord to the power connector on the WEB-TC device, and plug the AC adapter into an electrical outlet.

The **POWER/COMM** LED illuminates when +5 V power is supplied to the WEB-TC. If the voltage supply is less than +4.75 V or more than +5.25 V, the **POWER/COMM** LED will not light.

Refer to Figure 5 on page 22 for the location of the **POWER/COMM** LED.

Connecting the WEB-TC

A TCP/IP connection between the WEB-TC and the network or computer is required to access the device's web interface. A 10Base-T compatible Ethernet port, hub, or switch is required.

You can connect the WEB-TC using the following configurations:

- Connect to your Local Area Network (LAN) for communication within a private network/intranet; refer to the procedure on page 12.
- Connect to your LAN for communication across networks (communicate over the internet, for example); refer to the procedure on page 12.
- Connect directly to a computer's Ethernet port for local access (requires a crossover cable (not provided) or network hub); refer to the procedure on page 13.

Use the standard Ethernet cable provided to connect the WEB-TC to a TCP/IP-based local or wide area network, or to connect to a single PC through a hub or switch. Use a CAT-5 or higher crossover cable (not provided) to connect the WEB-TC to an Ethernet card installed in a computer.

Once a TCP/IP connection is established, you can access the web interface from devices within the same network by entering the URL that is printed on the WEB-TC. The device's home page will open. **Note**: To open the home page from devices installed outside of the network, enter the public IP address set for the device.

How you access the web interface once a TCP/IP connection is established depends on your configuration:

- When the WEB-TC is connected to the same network as the computer browser, enter the URL that is printed on the device to open the device's home page.
- When the WEB-TC is connected to a different network as the computer browser, enter the public IP address set for the device to open the device's home page. Refer to "Connecting to a LAN for communication across networks" below for more information.

Connecting to a LAN for communication within a network

Use this procedure to connect the WEB-TC to a local area network (LAN). When connected, all computers installed on the same network can access the WEB-TC's web interface.

Note: This procedure assumes the network server is equipped with DHCP (dynamic host configuration protocol), and will automatically assign an IP address to the WEB-TC when it is connected to the network.

1. Connect the WEB-TC to the network using the Ethernet cable provided.

   The **Link/Activity** LED will illuminate steady green to indicate that you have established a valid Ethernet connection.
2. Open your web browser, and enter the URL that is printed on the device label.

The WEB-TC **Measurements** page opens. You can view current measurement data from this page. A log in name (default is "webtc") and password (default is "mccdaq") are required to change configuration settings.

If the WEB-TC is not recognized by the network

If the WEB-TC Measurements page does not open, the server may not have DHCP, or DHCP may be disabled on the server. In either situation, assign a static IP address to the WEB-TC before connecting to the network. Refer to "Connecting the WEB-TC directly to a computer" on page 13 for instructions. After you assign the static IP address, connect to the network using the standard Ethernet cable shipped with the device, open the browser, and enter the static IP address.

Configuring the WEB-TC

All hardware options are configurable with *Insta*Cal or the web interface. *Insta*Cal must be used if any of the network parameters need to be changed, such as the IP address of your device. Configuration settings are stored in non-volatile memory in EEPROM, and are loaded on power up.

Refer to the sections "Using the web interface" on page 14 and "Configuring the WEB-TC using *Insta*Cal" on page 15 for detailed information.

Connecting to a LAN for communication across networks

In order to communicate with the WEB-TC from a computer connected to a different network, such as over the internet, you must change the network configuration of the network router.

In the following procedure, the WEB-TC is installed at the "host" LAN, and the computer is installed at the "client" LAN.

Caution! This procedure should only be performed by a network administrator or computer professional. Incorrect settings can significantly disrupt a network.

1. Connect the WEB-TC to a LAN (host) that has access to the Internet using the cable provided.

   The **Link/Activity** LED will illuminate steady green to indicate that you have established a valid Ethernet connection.
2. Configure the WEB-TC at the host LAN to access the web page:
   - Assign a fixed "private" static IP address to the WEB-TC.

- Configure the firewall/router to map a static "public" IP address to the "private" IP address assigned above. Record this address for use in step 3.
- Configure the firewall/router to forward incoming traffic from the public IP address to the HTTP port ("port 80") of the private static IP address.

  Note: If your network has an HTTP server already running, network address translation (NAT) allows different ports to redirect to the WEB-TC on port 80. Contact your network administrator or computer professional for more information.

  Note: To access the device using *Insta*Cal and the Universal Library, configure the firewall to allow incoming traffic to the UDP port ("port 54211" by default).

3. At the client LAN, open your web browser, and enter the "public" IP address recorded in step 2 above.
   Note: To access the WEB-TC by name, a DNS entry must be assigned.

The WEB-TC **Measurements** page opens. You can view current measurement data from this page. A log in name and password are required to change configuration settings.

Accessing the WEB-TC using *Insta*Cal and the Universal Library

*Insta*Cal cannot automatically detect a WEB-TC that is installed on a different subnet. To change configuration settings with *Insta*Cal or communicate with a WEB-TC using programs written with the Universal Library, manually add the public IP address to *Insta*Cal. *Insta*Cal can then search the public address provided for the WEB-TC. We recommend that the port number be set to *54211* for use with *Insta*Cal and the Universal Library. Port 80 is used for the web interface. For information on port configuration, contact your network administrator or computer professional.

Configuring the WEB-TC

All hardware options are configurable with *Insta*Cal or the web interface. *Insta*Cal must be used if any of the network parameters need to be changed, such as the IP address of your device. Configuration settings are stored in non-volatile memory in EEPROM, and are loaded on power up.

Refer to the sections "Using the web interface" on page 14 and "Configuring the WEB-TC using *Insta*Cal" on page 15 for detailed information.

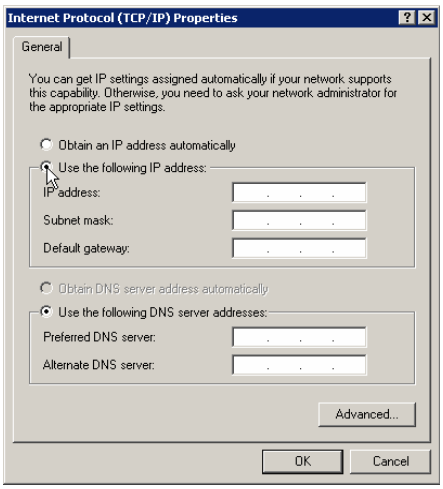
Connecting the WEB-TC directly to a computer

Use this procedure to connect the WEB-TC directly to a computer. This scenario provides local access only, and requires that you set up your computer to use a **static IP address** for communication with the WEB-TC. If you are not using a network hub, a CAT-5 (or higher) crossover cable is required to connect to the computer's Ethernet port. If you are connecting to your computer through a network hub or switch, the Ethernet cable provided with your device can be used.

Knowledge of network configuration is required

If you are not familiar with network configurations and have questions regarding your network settings, consult your network administrator or a computer professional.

1. Select Start > Control Panel > **Network Connections**.
2. Double-click on **Local Area Connection**.
3. Select **Internet Protocol (TCP/IP)** and click **Properties**.


Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
Subnet mask:
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

4. Select **Use the following IP address** option and enter the following:
   - *IP address*: Enter 192.168.0.102. Note that the last three digits of this number can be any number between 11 and 254, inclusive, but must be different from the IP address assigned to the device. The default IP address set for the WEB-TC is *192.168.0.101*.
   - *Subnet mask*: Enter 255.255.255.0.
   - *Default gateway*: Enter 192.168.0.1.

Caution! Assigning an arbitrary IP address could result in duplicate IP addresses on the network. This condition can cause a communication failure that affects both devices. Make sure when configuring static IP addresses that you set different addresses for each device.

5. Click **OK**.
6. Connect the WEB-TC's Ethernet port to your Ethernet hub using the supplied cable, or to your computer's Ethernet port using a CAT-5 or higher crossover cable.

   Note: If you connect to an Ethernet hub, you can use the Ethernet cable shipped with the device. If you have multiple WEB-TC devices, configure each device separately and assign a unique IP address to each device. You'll need to run *Insta*Cal to change the IP address from the default 192.168.0.101.

   When connected, the **Link/Activity** LED illuminates steady green to indicate that you have established a valid Ethernet connection, and blinks indicating network traffic. Refer to Figure 5 on page 22 for the location of the **Link/Activity** LED.
7. Open your browser and enter the URL address that is printed on the device label.

The WEB-TC **Measurements** page opens. You can view current measurement data from this page.

Configuring the WEB-TC

All hardware options are configurable with *Insta*Cal or the web interface. *Insta*Cal must be used if any of the network parameters need to be changed, such as the IP address of your device. Configuration settings are stored in non-volatile memory in EEPROM, and are loaded on power up.

Refer to the sections "Using the web interface" below and "Configuring the WEB-TC using *Insta*Cal" on page 15 for detailed information.

Using the web interface

You can view current measurements and configure hardware options from the device's web interface. The web interface provides four tabs. Each tab represents an HTML page that is stored on the device.

- **Measurements** tab (home page) – lists the thermocouple measurements, digital values, and alarm status read from each channel on the WEB-TC.

- **System Info** tab – summarizes the current network settings set for the WEB-TC, and provides a button that when pressed flashes the **POWER/COMM** LED on the device. Settings on this tab are not configurable via the web interface; use *Insta*Cal to configure network settings.
- **Configuration** tab – provides separate menu options for configuring your thermocouple, digital, and alarm options. To change configuration settings, enter the user name (default is "webtc") and password (default is "mccdaq") set for the device and click the **Log In** button. The user name and password cannot be changed from the web interface – you must use *Insta*Cal to change them.
  - *Temperature* menu option – Use the options on this page to set the thermocouple type for each temperature channel pair.

    The factory default configuration is *Disabled*. The Disabled mode disconnects the analog inputs from the terminal blocks and internally grounds all of the A/D inputs. Any channel you don't intend to use should be left disabled.
  - *DIO* menu option – Use the options on this page to set the direction of each digital I/O channel and value of each digital I/O channel configured for Output.
  - *Alarm* menu option – Use the options on this page to set up the temperature conditions to activate an alarm, and the output state of the channel (active high or low) when activated. You can configure up to eight independent alarms.

  The configuration options are enabled on these pages when you are logged in. The device is calibrated to the selected settings each time the "**Submit**" or "**Calibrate**" button is pressed.
- **Help** – summarizes the options on each web page, and includes step-by-step procedures for setting up your temperature channels, digital channels, and alarms.

Logging in to a device

Configurable options are disabled until you log in with the user name and password set for the device. Only one user can be logged in at a time. By default, the user name is set to *webtc*, and the password is set to *mccdaq*. You can change these values with *Insta*Cal.

Base64 encryption is used to encrypt the login name and password. JavaScript must be enabled on the browser to encrypt login information. If JavaScript is disabled on your browser when you log in, the user name and password values are transmitted as plain text with no encryption applied.

Configuring the WEB-TC using *Insta*Cal

All hardware and network options are configurable with *Insta*Cal. When the device is using its default configuration, *Insta*Cal has access to all functions on the device. Login is done in the background if the default user name and password are assigned to the device.

By default, the user name is set to *webtc*, and the password is set to *mccdaq*. You can change these values with *Insta*Cal. If the user name and password have been changed, configurable options are disabled until you log in with the user name and password set for the device. Only one user can be logged in at a time.

It is recommended that you change the user name and password from the default

To prevent unauthorized changes to your device configuration, make sure you change the user name and password values from the default. In the event that you forget your settings, they can be reset to the default values using the reset button on the device. Pressing and holding the reset button for three seconds sets all network settings back to default including the user name and password.

Note: For security purposes, do not change the log in information to the name and password used to access secure accounts, such as a credit card or bank account.

Setting the network parameters

Use *Insta*Cal to change configurable network settings set on the WEB-TC. The network parameters are not accessible via the web interface. The device is shipped configured with the following default settings.

Default network settings

Network setting	Default value
Identifier	not set, optional
DHCP setting	Enabled
IP address	192.168.0.101
Subnet mask	255.255.255.000
Gateway	192.168.0.1
Server	Enabled
User name	webtc
Password	mccdaq
MAC address	00:12:71:Cx:xx:xx, where *xxxxx* is the device's serial number (read-only)

The following default network parameters are programmable with *Insta*Cal.

- **Identifier**: Text that identifies the device. This value is optional, and is not set by default. Up to 48 alpha-numeric characters can be entered.
- **DHCP**: Enables configuration by a DHCP (Dynamic Host Configuration Protocol) Server. DHCP is a service that automatically assigns IP addresses to clients supporting the protocol. If the connected network has a DHCP server, the WEB-TC should be assigned an IP address shortly after it is powered up and attached to the network. *Insta*Cal will display the IP address assigned to the WEB-TC.

  The default DHCP setting for the WEB-TC is *Enabled*. Disable this setting when the server is not DHCP-enabled, or when entering a "static" IP address. Unless there is a reason to disable DHCP (such as the network server is not DHCP-enabled), we recommend that you leave DHCP enabled.
- **IP**: The Internet Protocol (IP) address that is stored on the device. Use this address when a DHCP server is not available or when DHCP is disabled.
- **Subnet**: The Subnet Mask that is stored on the device. The Subnet Mask is the part of the IP address that denotes the local Subnet. Use this address when a DHCP server is not available or when DHCP is disabled.
- **Gateway**: The Gateway IP address that is stored on the device. Use this address when a DHCP server is not available or when DHCP is disabled. A gateway is the IP address of the device that bridges subnets within a network.
- **Server**: Enables or disables the device's web page server. Enable this value to view the device's web page with a browser. Disable access to the web page when you want to restrict access to the device to *Insta*Cal or the Universal Library API.
- **User Name** and **Password**: The user name and password used to log in to a device session. Log in is required only when changing configurable options on the device. Default values can be changed with *Insta*Cal.

A unique 64-bit physical (MAC) address is also assigned to the device. This address is set at the factory and is not user-configurable.

Restoring factory default network settings

To restore network settings to factory default values, press and hold the device's **reset button** for three seconds. If *Insta*Cal is open when default settings are restored, click the **Refresh Boards** button on *Insta*Cal's tool bar to reflect the changes.

Calibrating the WEB-TC

The WEB-TC is calibrated to the selected device settings each time a *Submit* or *Calibrate* button is pressed on a web interface configuration page, or the *OK* button is pressed on an *Insta*Cal board configuration page.

Warm-up period

After you configure the hardware options, allow the WEB-TC to warm up for 30 minutes before taking measurements. This warm up time minimizes thermal drift and achieves the specified rated accuracy of measurements.

Signal I/O Connections

Screw terminal pin out

The WEB-TC has four rows of screw terminals — two rows on the top edge of the housing, and two rows on the bottom edge. There are 26 connections on each side. Signals are identified in Figure 2.

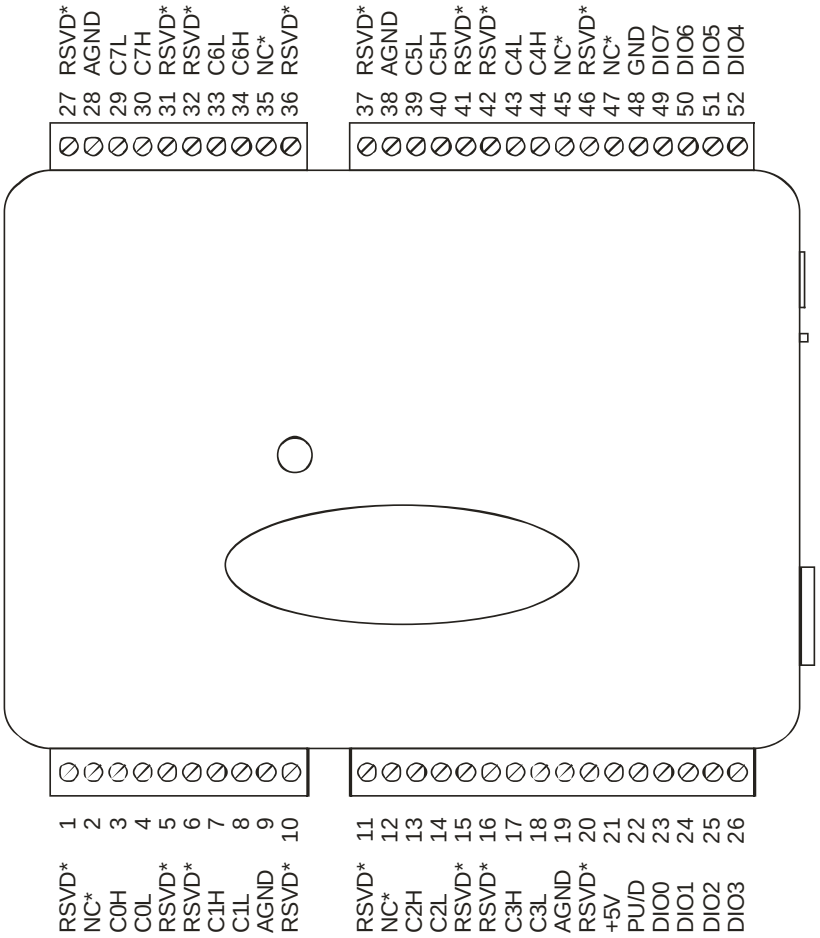


Figure 2. WEB-TC screw terminal pin numbers

*Do not make connections to the terminals labeled **NC** or **RSVD**.

WEB-TC screw terminal descriptions

Pin	Signal Name	Pin Description	Pin	Signal Name	Pin Description
1	RSVD*	Reserved	27	RSVD*	Reserved
2	NC*	No connect	28	AGND	Analog ground
3	C0H	CH0 sensor input (+)	29	C7L	CH7 sensor input (-)
4	C0L	CH0 sensor input (-)	30	C7H	CH7 sensor input (+)
5	RSVD*	Reserved	31	RSVD*	Reserved
6	RSVD*	Reserved	32	RSVD*	Reserved
7	C1H	CH1 sensor input (+)	33	C6L	CH6 sensor input (-)
8	C1L	CH1 sensor input (-)	34	C6H	CH6 sensor input (+)
9	AGND	Analog ground	35	NC*	No connect
10	RSVD*	Reserved	36	RSVD*	Reserved
11	RSVD*	Reserved	37	RSVD*	Reserved
12	NC*	"No Connect"	38	AGND	Analog ground
13	C2H	CH2 sensor input (+)	39	C5L	CH5 sensor input (-)
14	C2L	CH2 sensor input (-)	40	C5H	CH5 sensor input (+)
15	RSVD*	Reserved	41	RSVD*	Reserved
16	RSVD*	Reserved	42	RSVD*	Reserved
17	C3H	CH3 sensor input (+)	43	C4L	CH4 sensor input (-)
18	C3L	CH3 sensor input (-)	44	C4H	CH4 sensor input (+)
19	AGND	Analog ground	45	NC*	No connect
20	RSVD*	Reserved	46	RSVD*	Reserved
21	+5V	+5V output	47	NC*	No connect
22	PU/D	Pull-up/down for digital outputs	48	GND	Digital ground
23	DIO0	Digital Input/Output	49	DIO7	Digital Input/Output
24	DIO1	Digital Input/Output	50	DIO6	Digital Input/Output
25	DIO2	Digital Input/Output	51	DIO5	Digital Input/Output
26	DIO3	Digital Input/Output	52	DIO4	Digital Input/Output

*Make no connection to terminals labeled **NC** or **RSVD**.

Use 16 AWG to 30 AWG wire for your signal connections.

Tighten screw terminal connections

When making connections to the screw terminals, be sure to tighten the screw until tight. Simply touching the top of the screw terminal is not sufficient to make a proper connection.

Thermocouple input terminals (C0H/C0L to C7H/C7L)

You can connect up to eight thermocouples to the differential sensor inputs (C0H/C0L to C7H/C7L).

The WEB-TC supports type J, K, R, S, T, N, E, and B thermocouples. The thermocouple type you select will depend on your application needs. Review the temperature ranges and accuracies of each type to determine which is best suited for your application. You can connect a different thermocouple type to each channel.

CJC sensors

The WEB-TC has four built in high-resolution temperature sensors for thermocouple measurements. Each CJC sensor is dedicated to two thermocouple input channels, and is located behind the associated channel's screw terminal. These sensors measure the ambient temperature at the terminal block so that the cold junction voltage can be calculated.

Digital terminals (DIO0 to DIO7)

You can connect up to eight digital I/O lines to the screw terminals labeled **DIO0** to **DIO7**. Each terminal is software configurable for input or output. A **PU/D** terminal is provided for pull-up/down configuration (explained on page 19).

If a digital bit is set up as an alarm, the bit is configured for output and assumes the state defined by the alarm configuration.

Pull-up/down terminal (PU/D)

All digital I/O lines are connected through 47k to the **PU/D** pin, which is floating by default. For a pull-up configuration, connect the **PU/D** pin to the +5V pin. For a pull-down configuration, connect the **PU/D** pin to the **GND** pin.

Ground terminals (AGND and GND)

The analog ground (**AGND**) terminals (pins 9, 19, 28, 38) provide a common ground for the thermocouple input channels. The **AGND** pins are isolated from the **GND** pin and from earth ground. Thermocouple sensors can connect to voltages that are referenced to earth ground, as long the isolation between the **AGND** pins and earth ground is maintained.

The digital ground (**GND**) terminal (pin 48) provides a common ground for the digital I/O channels. The **GND** pin is isolated from the **AGND** pins and from earth ground.

Power terminal (+5V)

The **+5V** output terminal is isolated (500 VDC) from the thermocouple input channels.

Caution! The +5V terminal is an output. Do not connect an external power supply to this terminal or you may damage the WEB-TC and possibly the computer.

Thermocouple connections

A thermocouple consists of two dissimilar metals that are joined together at one end. When the junction of the metals is heated or cooled, a voltage is produced that correlates to temperature.

The WEB-TC makes fully differential thermocouple measurements without the need of ground-referencing resistors. A 32-bit floating point value in either a voltage or temperature format is returned by software. An open thermocouple detection feature is available for each analog input which automatically detects an open or broken thermocouple.

Use the web interface or *Insta*Cal to select the thermocouple type (J, K, R, S, T, N, E, and B) and one or more sensor input channel to connect the thermocouple.

Wiring configuration

Connect the thermocouple to the WEB-TC using a differential configuration, as shown in Figure 3.

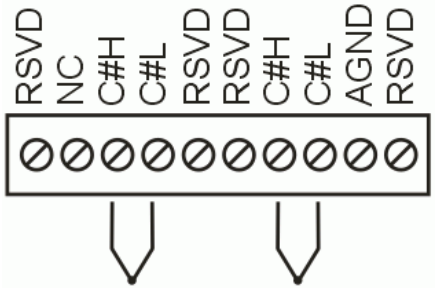


Figure 3. Typical thermocouple connection

Note: There are two high/low channel pairs on each terminal. The # indicates the channel number. Do not connect any signal or sensor to the pins labeled "NC" or "RSVD". These pins must remain disconnected for the WEB-TC to operate according to specification.

Thermocouples must be connected to the WEB-TC such that they are floating with respect to AGND (pins 9, 19, 28, and 38). The WEB-TC AGND pins are isolated from earth ground, so connecting thermocouple sensors to voltages referenced to earth ground is permissible as long as the isolation between the AGND pins and earth ground is maintained.

When thermocouples are attached to conductive surfaces, the voltage differential between multiple thermocouples must remain within ±1.4 V. For best results, we recommend the use of insulated or ungrounded thermocouples when possible.

Maximum input voltage between analog input and ground

The absolute maximum input voltage between an analog input and the isolated AGND pins is ±25 VDC when the WEB-TC is powered on, and ±40 VDC when the WEB-TC is powered off.

If you need to increase the length of your thermocouple, use the same type of thermocouple wires to minimize the error introduced by thermal EMFs.

Digital I/O connections

Connect up to eight digital I/O lines to the screw terminals labeled **DIO0** to **DIO7**. Configure each digital bit for either input or output. All digital I/O lines are connected through 47k to the **PU/D** pin, which is floating by default. For a pull-up configuration, connect the **PU/D** terminal to the +5V terminal. For a pull-down configuration, connect the **PU/D** terminal to the **GND** terminal.

When configuring the digital bits for input, the digital I/O terminals can detect the state of a TTL-compatible device. The ground (**GND**) terminal (pin 48) provides a common ground for the digital I/O channels. Refer to the schematic shown in Figure 4. If the switch is set to the +5V input, DIO0 reads *TRUE* (1). If the switch is moved to GND, DIO0 reads *FALSE* (0).

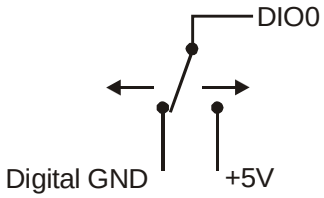


Figure 4. Schematic showing switch detection by digital channel DIO0

When configuring the digital bits, use the switch on the side of the device to set the voltage to either 5 V or 3.3 V (see page 23 for more information). Refer to the digital I/O specification on page 31 for the maximum and minimum threshold levels for each setting.

If a digital bit is set up as an alarm, that bit is configured for output and assumes the state defined by the alarm configuration.

Caution! The ground pin labeled **GND** (pin 48) is isolated from the **AGND** pins and from earth ground. If a connection is made to earth ground and **AGND**, the thermocouples are no longer isolated. In this case, thermocouples must not be connected to any conductive surfaces that may be referenced to earth ground.

For general information regarding digital signal connections and digital I/O techniques, refer to the *Guide to Signal Connections* (available on our web site at www.mccdaq.com/signals/signals.pdf).

Configuring the DIO channels to generate alarms

The WEB-TC features eight independent temperature alarms. All alarm options are configurable using the web browser or *Insta*Cal.

When a digital bit is configured as an alarm, that bit will be configured as an output on the next power cycle and assume the state defined by the alarm configuration.

Each alarm controls an associated digital I/O channel as an alarm output. The input to each alarm is one of the thermocouple input channels. You set up the temperature conditions to activate an alarm, and the output state of the channel (active high or low) when activated. When an alarm is enabled, its associated I/O line is set to output and driven to the appropriate state determined by the alarm options and input temperature. Alarm configuration settings are stored in non-volatile memory and are loaded on power up.

Functional Details

Thermocouple measurements

The WEB-TC hardware level-shifts the thermocouple's output voltage into the A/D's common mode input range by applying +2.5 V to the thermocouple's low side at the C#L input. Always connect thermocouple sensors to the WEB-TC in a floating fashion. Do not attempt to connect the thermocouple low side C#L to GND or to a ground referencing resistor.

Cold junction compensation (CJC)

When connecting the thermocouple sensor leads to the sensor input channel, the dissimilar metals at the WEB-TC terminal blocks produce two additional thermocouple junctions. This junction creates a small voltage error term which must be removed from the overall sensor measurement using a cold junction compensation technique. The measured voltage includes both the thermocouple voltage and the cold junction voltage. To compensate for the additional cold junction voltage, the WEB-TC subtracts the *cold junction* voltage from the thermocouple voltage.

The WEB-TC has four high-resolution CJC temperature sensors integrated into the design. The CJC sensors are configured as one sensor for each channel pair. CJC sensors measure the average temperature at the terminal block so that the cold junction voltage can be calculated. A software algorithm automatically corrects for the additional thermocouples created at the terminal blocks by subtracting the calculated cold junction voltage from the analog input's thermocouple voltage measurement.

Increasing the thermocouple length

If you need to increase the length of your thermocouple, use the same type of thermocouple wires to minimize the error introduced by thermal EMFs.

Data linearization

After the CJC correction is performed on the measurement data, an on-board microcontroller automatically linearizes the thermocouple measurement data using National Institute of Standards and Technology (NIST) linearization coefficients for the selected thermocouple type. The measurement data is then output as a 32-bit floating point value in the configured format (voltage or temperature).

Open-thermocouple detection (OTD)

The WEB-TC is equipped with open-thermocouple detection for each analog input channel. OTD is automatically enabled when the channel pair is configured for thermocouple sensors.

With OTD, any open-circuit or short-circuit condition at the thermocouple sensor is detected by the software. An open channel is detected by driving the input voltage to a negative value outside the range of any thermocouple output. The software recognizes this as an invalid reading and flags the appropriate channel. The firmware continues to sample all channels when OTD is detected.

External components

The WEB-TC has the following external components, as shown in Figure 5.

- Screw terminals
- Ethernet port
- External power connector
- Status LEDs (POWER/COMM and LINK/ACTIVITY)
- Digital output voltage switch
- Factory default reset button

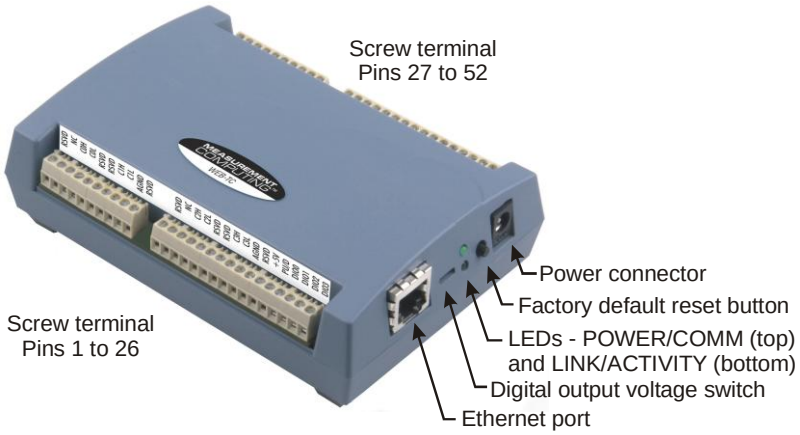


Figure 5. WEB-TC component locations

Screw terminals

The screw terminals provide connections for sensors, digital channels, power, and ground. Detailed information is provided in Chapter 3, Signal I/O Connections, beginning on page 17.

Ethernet port

The WEB-TC has one 10BASE-T communication port. The port connector is an eight-position RJ-45 connector. Use the Ethernet cable provided to connect the device to a local or wide area network or to a hub attached to a single computer. Use a CAT-5 (or higher) shielded or unshielded twisted pair crossover cable to connect directly to a computer. The maximum communication distance without using a repeater is 100 meters. Data can transmit up to 100 meters at speeds of up to 100 Mbps using only one crossover Ethernet cable connected to your computer.

External power connector

Use the supplied external power supply (MCC p/n PS-5V2AEPS) to power the WEB-TC.

POWER/COMM LED

The **POWER/COMM** LED (upper LED) is steady green when external power is supplied. The WEB-TC has an on-board voltage supervisory circuit that monitors the 5 V external power supply. The table below explains the function of the **POWER/COMM** LED.

LED	Indication
Steady green	4.75 V to 5.25 V external power is supplied to the WEB-TC.
Off	Check the following: ▪ External power is not supplied; verify that the supply is connected to the external power connector. ▪ A power fault has occurred. A power fault occurs when the input power falls outside of the specified voltage range of the external supply (4.75 V to 5.25 V).

LINK/ACTIVITY LED

The **LINK/ACTIVITY** LED (lower LED) blinks green when a data packet is sent or received over the Ethernet connection. The table below explains the function of the **LINK/ACTIVITY** LED.

LED	Indication
Blinking green	Data is being transmitted or received over the Ethernet connection.
Steady green	▪ The Ethernet is idle. ▪ Your network traffic has reached its maximum limit, and no communication is possible. Check with your Network Administrator.
Off	▪ The Ethernet cable is not connected to the WEB-TC. ▪ The Ethernet cable is not connected to the network. ▪ The Ethernet cable is damaged. ▪ The Ethernet cable is not the correct type (a crossover cable is required for a direct connection.)

Digital logic voltage switch

The digital logic voltage switch lets you set the voltage to either 3.3 V or 5 V (default setting).

To interface with 3.3 V logic, use the 3.3 V setting. To interface with 5 V logic, use the 5 V setting. Refer to the digital I/O specification on page 31 for the maximum and minimum threshold levels for each setting.

Figure 6. Output voltage switch positions

To change the logic voltage, slide the switch left or right with a screwdriver.

Factory default reset button

Press and hold this button for three seconds to restore the factory default network settings on the WEB-TC. When held for 3 seconds, the **POWER** LED will turn off for a short time, indicating a reset is in process. When the POWER LED turns back on, reset is complete and the factory default network settings have been restored.

Ethernet Troubleshooting

There are typically only two reasons why you would be unable to communicate with the WEB-TC and access the web interface:

- The WEB-TC is configured incorrectly, or is operating incorrectly.
- The network is configured incorrectly. Though the WEB-TC is functioning normally, you are unable to communicate with it over the network.

Though a detailed treatment of debugging the network is beyond the scope of this manual, there are a few things to try to determine if the problem experienced is a problem with the WEB-TC or with the network configuration.

Perform the procedures below to verify the physical and network connections.

Contact your network administrator for issues with your network configuration

Measurement Computing provides technical support for WEB-TC connectivity and operation only. For networking issues, contact your network administrator or computer professional.

Check the WEB-TC status LEDs

1. Verify the external power connection. When external power is supplied to the WEB-TC, the **POWER/COMM** LED illuminates steady green.
   - If the **POWER/COMM** LED is off, check the power cable and the socket that the cable is plugged into. If the cable is good, plugged in, and the power to the socket is on, then the WEB-TC is not powering up correctly. Contact MCC technical support. Refer to Getting help on page 27 for contact information.
2. Verify the Ethernet connection. The **LINK/ACTIVITY** LED illuminates steady green when the WEB-TC is connected to an active Ethernet hub or switch.
   - If the **LINK/ACTIVITY** LED is off, verify that the Ethernet cable is the correct type, that it is not damaged , and that it is connected correctly between the WEB-TC and a known functional server/hub/switch (or connected to your computer if you are connected directly).
   - If the Ethernet cable is plugged into a wall socket, check with your Network Administrator or computer professional that the wall socket is active, and that it is connected to an active Ethernet hub or switch.

   If you are properly connected to an active server/hub/switch and the LED is still off, there is a problem with the WEB-TC. Contact MCC technical support. Refer to Getting help on page 27 for contact information.
3. Verify the network connection:

   When the WEB-TC is connected to a network, the **LINK/ACTIVITY** LED flashes when there is activity on the network.
   - If the **LINK/ACTIVITY** LED is solid green, your network's traffic is at its maximum limit and no communication is possible, or the network traffic is idle. Check with your network administrator.
   - If the LINK/ACTIVITY LED is not illuminated, there are two possibilities:

     You are not connected to the network, even though the WEB-TC is connected to an active server/hub/switch. An average network has at least some traffic that causes the LED to blink. Perform the procedure listed in Checking your TCP/IP settings on page 25.

     The WEB-TC is not receiving data, and the network connection is verified by a network administrator. Contact MCC technical support. Refer to Getting help on page 27 for contact information.

When the WEB-TC is directly connected to a computer via a crossover cable or a single hub/switch, the **LINK/ACTIVITY** LED flashes when data is transmitted or received over the Ethernet connection.

- If the **LINK/ACTIVITY** LED is not flashing, there are two possibilities:

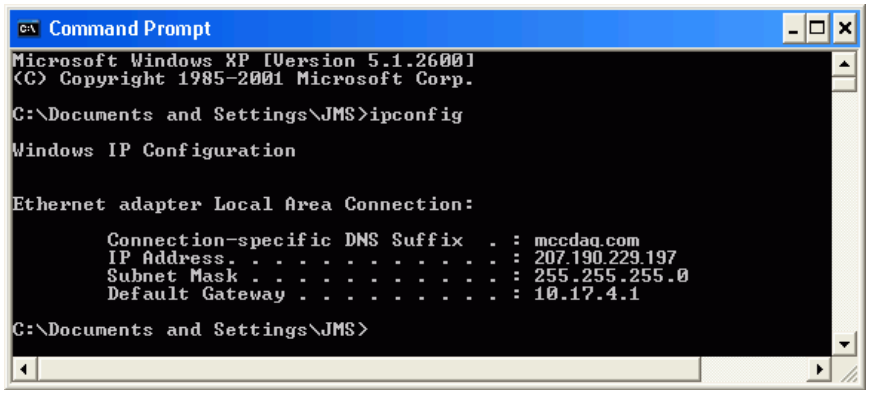
  Your computer is not transmitting — verify that your TCP/IP settings are correct, and that you are using a valid IP address for both your computer and WEB-TC. Perform the procedure listed in Check the network settings on the computer TCP/IP settings below.

  The WEB-TC is not receiving — contact MCC technical support. Refer to Getting help on page 27 for contact information.

Check the network settings on the computer

If the **LINK/ACTIVITY** LED is not flashing, verify that your TCP/IP settings are correct, and that you are using a valid IP address for both your computer and the WEB-TC. Use the `ipconfig` utility to return the TCP/IP settings on your computer.

1. Open a DOS Command Prompt window from your computer.
2. Enter `ipconfig` and press the **Return** key. Your computer will display all TCP/IP network configuration values currently set on the computer. An example is shown here.


Command Prompt
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.
C:\Documents and Settings\JMS>ipconfig
Windows IP Configuration
Ethernet adapter Local Area Connection:
Connection-specific DNS Suffix . : mccdaq.com
IP Address. . . . . : 207.190.229.197
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 10.17.4.1
C:\Documents and Settings\JMS>

- If the IP Address or Subnet Mask information are all 0's, or if the first three sets (octets) of numbers in either the IP address or Subnet Mask do not match the device's network settings, then the computer will be unable to communicate with the WEB-TC. Contact your network administrator or computer professional.

Check whether DHCP is enabled on the network server

You can determine whether DHCP is enabled on the network server — open a DOS Command Prompt and enter `ipconfig /all`. Your computer will display additional TCP/IP information, including the status of DHCP on the network server.

Contact your network administrator regarding network settings

Changes to network configuration should only be performed by your network administrator or computer professional.

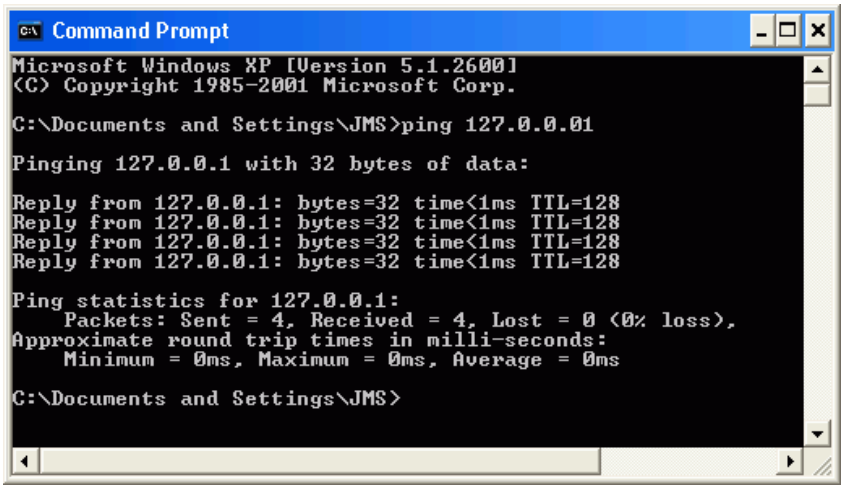
Verify that the computer is connected to the network

You can ping (Packet InterNet Groper) the computer to verify that it is connecting to your network. Ping is a diagnostic utility used to send a request to a device. The device then returns a response.

- Enter `ping` followed by the IP address of the computer. Using the address returned in the example above with ipconfig, enter `ping 127.0.0.01` and press the **Return** key.

  This address tells the computer to test its network setup.

If your computer is connected to the network, a message similar to the one shown here is returned.


Command Prompt
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.
C:\Documents and Settings\JMS>ping 127.0.0.01
Pinging 127.0.0.1 with 32 bytes of data:
Reply from 127.0.0.1: bytes=32 time<1ms TTL=128
Reply from 127.0.0.1: bytes=32 time<1ms TTL=128
Reply from 127.0.0.1: bytes=32 time<1ms TTL=128
Reply from 127.0.0.1: bytes=32 time<1ms TTL=128
Ping statistics for 127.0.0.1:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms
C:\Documents and Settings\JMS>

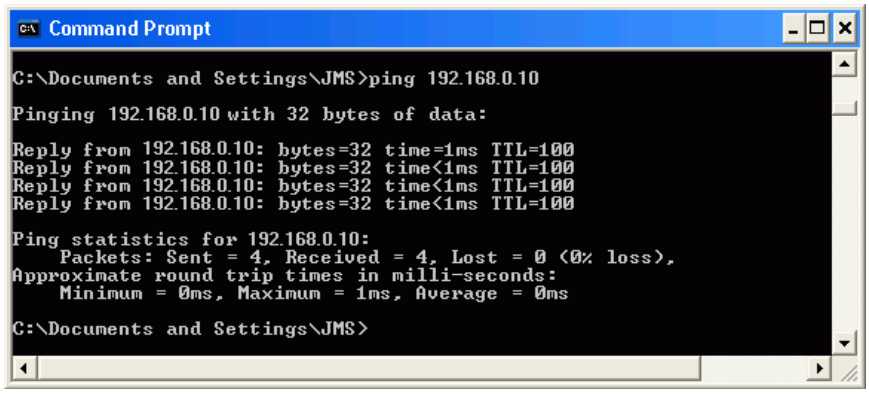
If your computer is not connected to the network, a "`Request timed out`" error or a "`Destination host unreachable`" message is returned. Check with your network administrator.

Verify the network path to the WEB-TC

You can ping the WEB-TC to verify that the network path from the computer to the device is set up correctly.

- Enter ping followed by the IP address of the WEB-TC.

  For example, enter `ping 192.168.0.10` and press the **Return** key. If you can successfully communicate with the WEB-TC, a message similar to the one below is returned.


Command Prompt
C:\Documents and Settings\JMS>ping 192.168.0.10
Pinging 192.168.0.10 with 32 bytes of data:
Reply from 192.168.0.10: bytes=32 time=1ms TTL=100
Reply from 192.168.0.10: bytes=32 time<1ms TTL=100
Reply from 192.168.0.10: bytes=32 time<1ms TTL=100
Reply from 192.168.0.10: bytes=32 time<1ms TTL=100
Ping statistics for 192.168.0.10:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 1ms, Average = 0ms
C:\Documents and Settings\JMS>

If a "`Request timed out`" error or a "`Destination host unreachable`" message is returned, the network settings may not be set correctly. Press the **RESET** button on the WEB-TC to reset the network configuration settings to factory default values. If DHCP is enabled, an IP address is automatically assigned to the device. If DHCP is not enabled, assign the device a unique static IP address and re-establish communication with the WEB-TC. Refer to Connecting the WEB-TC directly to a computer on page 13 for information on how to assign a static IP address.

If the **RESET** button does not restore the network settings, the microcontroller on the WEB-TC may not be working. Contact MCC technical support. Refer to Getting help on page 27 for contact information.

Contact your network administrator regarding network settings

Changes to network configuration should only be performed by your network administrator or computer professional.

Verify the network path to a remote WEB-TC

You can ping the network where the WEB-TC is installed to verify that the network path from the computer to a device installed on a different network is set up correctly.

- Enter `ping` followed by the public IP address of the network where the WEB-TC is installed.
- If a "`Request timed out`" error or a "`Destination host unreachable`" message is returned, verify that you have the correct public address for the network where the WEB-TC is installed.

If you get a response from the ping of the public network but still cannot communicate with the WEB-TC, check the following:

- A unique, fixed "static" IP address has been assigned to the WEB-TC.
- The firewall is configured to allow incoming traffic to the HTTP port ("port 80") for access to the web page.
- The firewall is configured to allow incoming traffic to the UDP port ("port 54211" by default) for access through *Insta*Cal and the Universal Library.
- The network at the public IP address is configured to access the fixed address assigned to the WEB-TC.

Contact your network administrator regarding firewall settings

Changes to network configuration should only be performed by your network administrator or computer professional.

Check cached information

When your network configuration changes - for example, when you change the static address on one of your devices - you may have obsolete information on PCs that have previously accessed your device. You may be able to update this information simply by disconnecting the network cable from the PC on which the problem exists and reconnecting it. After a short time, the cached information should update. If this doesn't work, the following procedures may help.

Deleting a NetBIOS table entry

If NetBIOS is enabled, "nbtstat -c" will provide a list of names and IP addresses. If the webtc name is listed, check the associated IP address. If it is different, try typing "nbtstat -R" to purge the NetBIOS cache.

Deleting an ARP table

If you suspect that two devices on a network are assigned the same IP address, you can delete the ARP table (Address Resolution Protocol). Do the following:

1. Open a Command Prompt (DOS) window.
2. Enter `arp -d` followed by the address found in step 2 (`192.168.0.102` for example) and press **Enter**.

The ARP table will update with the current IP addresses assigned to devices on the network.

Getting help

If you are unable to communicate with the WEB-TC, first contact your network administrator or computer professional to verify that you are using the correct TCP/IP network settings, and that your network configuration is working.

If the network configuration and settings are properly set but you still cannot communicate with the WEB-TC, the problem may be with the WEB-TC. For hardware related issues, contact Measurement Computing Corporation technical support by phone, fax, or email.

- Phone: 508-946-5100 and follow the instructions for reaching Tech Support.
- Fax: 508-946-9500 to the attention of Tech Support
- Email: techsupport@mccdaq.com

For international customers, contact the local distributor where you purchased the WEB-TC. Click on this link www.measurementcomputing.com/sales.asp to locate your distributor.

Specifications

Typical for 25 °C unless otherwise specified.
Specifications in *italic* text are guaranteed by design.

Analog input

Table 1. Generic analog input specifications

Parameter	Conditions	Specification
A/D converters		Four dual 24-bit, Sigma-Delta type
Number of channels		8 differential
Input isolation		*500 VDC minimum between field wiring and power supply input.*
Channel configuration		Software programmable to match sensor type
Differential input voltage range	Thermocouple	±0.080 V
Absolute maximum input voltage	*±C0x through ±C7x relative to AGND (pins 9, 19, 28, 38)*	*±25 V (power on)* *±40 V (power off)*
Input impedance		*5 Gigohm (power on)* *1 Mohm (power off)*
Input leakage current	*Open thermocouple detect disabled*	*30 nA max.*
	Open thermocouple detect enabled	*105 nA max.*
Common mode rejection ratio	*f_{IN} = 60 Hz*	*100 dB min.*
ADC Resolution		24 bits
ADC No missing codes		*24 bits*
Input coupling		DC
Warm-up time		30 minutes min.
Open thermocouple detect		The maximum open detection time is 3 seconds.
CJC sensor accuracy	*15 °C to 35 °C*	*-0.75 °C to 0.5 °C max.*
	0 °C to 55 °C	*-1.5 °C to 1.25 °C max.*

Channel configurations

Table 2. Channel configuration specifications

Sensor Category	Conditions	Specification
Thermocouple	J, K, S, R, B, E, T, or N	8 differential channels

Note 1: Channel configuration information is stored on a EEPROM external to the isolated microcontroller by the firmware whenever any item is modified. Modification is performed by commands issued over Ethernet from an external application, and the configuration is made non-volatile through the use of the EEPROM.

Note 2: The factory default configuration is *Type J*.

Compatible thermocouples

Table 3. Compatible sensor type specifications

Parameter	Conditions
Thermocouple	J: -210 °C to 1200 °C
	K: -270 °C to 1372 °C
	R: -50 °C to 1768 °C
	S: -50 °C to 1768 °C
	T: -270 °C to 400 °C
	N: -270 °C to 1300 °C
	E: -270 °C to 1000 °C
	B: 0 °C to 1820 °C

Accuracy

Thermocouple measurement accuracy

Table 4. Thermocouple accuracy specifications, including CJC measurement error. All specifications are (±).

Sensor Type	Sensor temperature	Accuracy error maximum (°C)	Accuracy error typical (°C)	Tempco (°C/°C)
J	-210 °C	3.098	1.762	0.040
	0 °C	1.282	0.724	
	1200 °C	1.178	0.684	
K	-210 °C	3.318	1.843	0.045
	0 °C	1.292	0.730	
	1372 °C	1.495	0.799	
S	-50 °C	1.892	1.058	0.027
	250 °C	0.853	0.479	
	1768 °C	0.734	0.416	
R	-50 °C	2.010	1.124	0.025
	250 °C	0.844	0.475	
	1768 °C	0.612	0.347	
B	250 °C	2.199	2.192	0.004
	700 °C	0.824	0.821	
	1820 °C	0.471	0.469	
E	-200 °C	3.050	1.708	0.038
	0 °C	1.465	0.826	
	1000 °C	1.010	0.564	
T	-200 °C	3.226	1.797	0.045
	0 °C	1.334	0.754	
	400 °C	0.856	0.496	
N	-200 °C	3.406	1.897	0.035
	0 °C	1.300	0.735	
	1300 °C	0.978	0.571	

Note 3: Thermocouple measurement accuracy specifications include polynomial linearization, cold-junction compensation and system noise. These specs are for one year, or 3000 operating hours, whichever comes first, and for operation of the WEB-TC between 15 °C and 35 °C after 30 minute warm-up. The tempco should be applied to the accuracy specifications for operation at an ambient temperature outside of the 15 °C and 35 °C range. There are total of four CJC sensors, two per side of the module. Each CJC sensor is dedicated to one of the four channel pairs. The accuracy listed above assumes the screw terminals are at the same temperature as the CJC sensor. Errors shown do not include inherent thermocouple error. Contact your thermocouple supplier for details on the actual thermocouple accuracy error.

Note 4: Thermocouples must be connected to the WEB-TC such that they are floating with respect to AGND (pins 9, 19, 28, 38, 48). The WEB-TC AGND pins are isolated from earth ground. You can connect thermocouple sensors to voltages referenced to earth ground as long as the isolation between the AGND pins and earth ground is maintained.

Note 5: When thermocouples are attached to conductive surfaces, the voltage differential between multiple thermocouples must remain within ±1.4 V. For best results, we recommend using insulated or ungrounded thermocouples when possible.

Throughput rate

Table 5. Throughput rate specifications

Number of Input Channels	Maximum Throughput
1	2 Samples/second
2	2 S/s on each channel, 4 S/s total
3	2 S/s on each channel, 6 S/s total
4	2 S/s on each channel, 8 S/s total
5	2 S/s on each channel, 10 S/s total
6	2 S/s on each channel, 12 S/s total
7	2 S/s on each channel, 14 S/s total
8	2 S/s on each channel, 16 S/s total

Note 6: The analog inputs are configured to run continuously. Each channel is sampled twice per second. The maximum latency between when a sample is acquired and the temperature data is provided by the Ethernet unit is approximately 0.5 seconds.

Digital input/output

Table 6. Digital input/output specifications

Digital type	CMOS
Number of I/O	8 (DIO0 through DIO7)
Configuration	Independently configured for input or output. Switch selectable output voltages: +5 V and +3.3 V
Power on conditions	Power on reset is Input mode except when bits are configured to operate as alarms.
Pull-up/pull-down configuration	All pins are connected to 47 kOhm resistors that share a common point accessible at Pin 22 of the device (PU/D). This pin is floating by default and is user-configurable via external connection. For pull-up mode, connect this pin to Pin 21 (+5V). For pull-down mode, connect this pin to Pin 48 (GND).
Digital I/O transfer rate (software paced)	▪ Digital input – 50 port reads or single bit reads per second typical. ▪ Digital output – 100 port writes or single bit writes per second typical.
Input high voltage (+5 V mode)	4 V min, 5.5 V absolute max.
Input high voltage (+3.3 V mode)	2.64 V min, 5.5 V absolute max.
Input low voltage (+5 V mode)	1 V max., -0.3 V absolute min.
Input low voltage (+3.3 V mode)	0.66 V max., -0.3 V absolute min.
Output low voltage (IOL = 2.5 mA)	0.6 V max.
Output high voltage (IOH=-2.5 mA)	4.3 V min. (+5 V mode), 2.7 V (+3.3 V mode)

Note 7: Ground pins on the WEB-TC labeled GND are isolated from AGND pins and from earth ground.

Temperature alarms

Table 7. Temperature alarm specifications

Number of alarms	8 (one per digital I/O line)
Alarm functionality	Each alarm controls its associated digital I/O line as an alarm output. The input to each alarm may be any of the analog temperature input channels. When an alarm is enabled, its associated I/O line is set to output and driven to the appropriate state determined by the alarm options and input temperature. The alarm configurations are stored in non-volatile memory and are loaded at power on.
Alarm input modes	▪ Alarm when input temperature > T1 ▪ Alarm when input temperature > T1, reset alarm when input temperature goes below T2 ▪ Alarm when input temperature < T1 ▪ Alarm when input temperature < T1, reset alarm when input temperature goes above T2 ▪ Alarm when input temperature is < T1 or > T2 Note: T1 and T2 may be independently set for each alarm.
Alarm output modes	▪ Disabled, digital I/O line may be used for normal operation ▪ Enabled, active high output (digital I/O line goes high when alarm condition is met) ▪ Enabled, active low output (digital I/O line goes low when alarm condition is met)
Alarm update rate	1 second

Memory

Table 8. Memory specifications

EEPROM	512 bytes for sensor configuration
FLASH	2 MB for device configuration and website storage

Microcontroller

Table 9. Microcontroller specifications

Type	One high-performance 8-bit RISC microcontroller (isolated) One high-performance 16-bit RISC microcontroller (non-isolated)

Power

Table 10. Power specifications

Parameter	Conditions	Specification
Supply current (Note 9)	Continuous mode	440 mA max.
External power input (Note 8)		+5 VDC ± 5% (+5 VDC power supply provided)
External power supply (included)	MCC p/n PS-5V2AEPS	+5 VDC, 10W, 5% regulation
Voltage supervisor limits	4.75 V > V_{ext} or V_{ext} > 5.25 V	PWR LED = Off; (power fault)
	4.75 V < V_{ext} < 5.25 V	PWR LED = On
User output voltage range	Available at +5V screw terminal	4.65 V min., 5.25 V max.
User output current available	Available at +5V screw terminal	10 mA max

Note 8: Voltage specification applies at barrel plug power input. The power supply provided with the board meets this specification at the rated total power supply current. If a different power supply is used, small line resistances could cause significant voltage drop between the power supply and the barrel plug input.

Note 9: This is the total current requirement for the WEB-TC which includes up to 20 mA for the LEDs and 10 mA for the user voltage output.

Network

Ethernet compliance

Table 11. Ethernet compliance specifications

Device type	*IEEE 802.3 Ethernet 10Base-T*
Device compatibility	*IEEE 802.3-2003 10 Mpbs Media Access Control*

Ethernet connection

Table 12. Ethernet connection specifications

Ethernet type	*10Base-T*
Connector	*RJ-45, 8 position*
Cable	*CAT-5 shielded, unshielded twisted pair*
Length	*100 meters max.*
MAC address	00:12:71:Cx:xx:xx, where xxxxx is the device's serial number

Network factory default settings

Table 13. Factory default specifications

Factory default IP address	192.168.0.101
Factory default subnet mask	255.255.255.0
Factory default Gateway	192.168.0.1
Factory default DHCP setting	Enabled
Factory default user name	"webtc"
Factory default password	"mccdaq"
Web Server	Enabled

Network protocols

Table 14. Factory default specifications

Protocols implemented	IP, ARP, ICMP, DHCP, UDP, TCP, NBNS, HTTP Protocols using UDP or TCP for transport communicate on their IETF assigned ports (for example HTTP on TCP port 80).
UDP messaging protocol	UDP port 54211
TCP downloading protocol	TCP port 54267
HTTP 1.0 alternate port	TCP port 49152-65535 (not including 54267)
Network name	"webtc_xxxxx", where xxxxx is the device's serial number
Network name publication	via NBNS (responds to b-node broadcasts, therefore only available on the local subnet)
Max number of simultaneous HTTP connections	3
Max number of non-HTTP TCP sockets	5

Network security

Table 15. Factory default specifications

Security implementation	IP address based session manager with user-name/password login for configuration and control transactions (data is not secured.)
Session timeout	5 minutes with no activity
User-name/password encryption	Base64 (The default web page does not support encryption if Javascript is disabled in the web browser.)
Vulnerabilities	Denial of service attacks, user-name/password spoofing, script probing and simple decryption

LED displays and the factory reset button

Table 16. LED and button configurations

POWER/COMM LED (top)	4.75 V < V_{ext} < 5.25 V On V_{ext} < 4.75 V, V_{ext} > 5.25 V Off (power fault) Blinks during microcontroller communications.
LINK/ACTTIVITY LED (bottom)	On when there is a valid Ethernet connection and blinks when an Ethernet packet is sent or received.
Factory reset button	When held for 3 seconds, the POWER LED will turn off for a short time, indicating a reset is in process. When the POWER LED turns back on, reset is complete and the factory default network settings have been restored.

Environment

Table 17. Environmental specifications

Operating temperature range	0 to 55 ° C
Storage temperature range	-40 to 85 ° C
Humidity	0 to 90% non-condensing

Mechanical

Table 18. Mechanical specifications

Dimensions	127 mm (L) x 88.9 mm (W) x 35.56 (H)

Screw terminal connector type and pin out

Table 19. Screw terminal connector specifications

Connector type	Screw terminal
Wire gauge range	16 AWG to 30 AWG

Table 20. Screw terminal pin out

Pin	Signal Name	Pin Description	Pin	Signal Name	Pin Description
1	RSVD	Reserved - see Note 10	27	RSVD	Reserved - see Note 10
2	NC	No connect - see Note 10	28	AGND	Analog ground
3	C0H	CH0 sensor input (+)	29	C7L	CH7 sensor input (-)
4	C0L	CH0 sensor input (-)	30	C7H	CH7 sensor input (+)
5	RSVD	Reserved - see Note 10	31	RSVD	Reserved - see Note 10
6	RSVD	Reserved - see Note 10	32	RSVD	Reserved - see Note 10
7	C1H	CH1 sensor input (+)	33	C6L	CH6 sensor input (-)
8	C1L	CH1 sensor input (-)	34	C6H	CH6 sensor input (+)
9	AGND	Analog ground	35	NC	No connect - see Note 10
10	RSVD	Reserved - see Note 10	36	RSVD	Reserved - see Note 10
11	RSVD	Reserved - see Note 10	37	RSVD	Reserved - see Note 10
12	NC	No connect - see Note 10	38	AGND	Analog ground
13	C2H	CH2 sensor input (+)	39	C5L	CH5 sensor input (-)
14	C2L	CH2 sensor input (-)	40	C5H	CH5 sensor input (+)
15	RSVD	Reserved - see Note 10	41	RSVD	Reserved - see Note 10
16	RSVD	Reserved - see Note 10	42	RSVD	Reserved - see Note 10
17	C3H	CH3 sensor input (+)	43	C4L	CH4 sensor input (-)
18	C3L	CH3 sensor input (-)	44	C4H	CH4 sensor input (+)
19	AGND	Analog ground	45	NC	No connect - see Note 10
20	RSVD	Reserved - see Note 10	46	RSVD	Reserved - see Note 10
21	+5V	+5V output	47	NC	No connect - see Note 10
22	PU/D	Pull-up/down for digital outputs	48	GND	Digital ground
23	DIO0	Digital Input/Output	49	DIO7	Digital Input/Output
24	DIO1	Digital Input/Output	50	DIO6	Digital Input/Output
25	DIO2	Digital Input/Output	51	DIO5	Digital Input/Output
26	DIO3	Digital Input/Output	52	DIO4	Digital Input/Output

Note 10: Do not make connections to pins marked "NC" or "RSVD".

CE Declaration of Conformity

Manufacturer: Measurement Computing Corporation
Address: 10 Commerce Way
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Norton, MA 02766
USA

Category: Electrical equipment for measurement, control and laboratory use.

Measurement Computing Corporation declares under sole responsibility that the product

WEB-TC

EU EMC Directive 89/336/EEC: Electromagnetic Compatibility, EN 61326 (1997) Amendment 1 (1998)

Emissions: Group 1, Class A

- EN 55011 (1990)/CISPR 11: Radiated and Conducted emissions.

Immunity: EN61326, Annex A

- IEC 61000-4-2 (1995): Electrostatic Discharge immunity, Criteria B.
- IEC 61000-4-3 (1995): Radiated Electromagnetic Field immunity Criteria B.
- IEC 61000-4-4 (1995): Electric fast transient burst immunity Criteria B.
- IEC 61000-4-5 (1995): Surge immunity Criteria A.
- IEC 61000-4-6 (1996): Radio frequency common mode immunity Criteria B.
- IEC 61000-4-8 (1994): Power frequency magnetic field immunity Criteria A.
- IEC 61000-4-11 (1994): Interrupt immunity Criteria A.

Declaration of Conformity based on tests conducted by Chomerics Test Services, Woburn, MA 01801, USA in August, 2007. Test records are outlined in Chomerics Test Report #EMI4891A.07.

We hereby declare that the equipment specified conforms to the above Directives and Standards.

Carl Haapaoja, Director of Quality Assurance

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